Pre-Luning-Fencemaker Metamorphism and Deformation in the Northern Sand Springs Range, Nevada

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Objectives:

1) Create a 1:8000 scale map of a small portion of the San Springs Assemblage within the Luning-Fencemaker Fold and Thrust Belt
2) Collect fault-kinematic data on low-angle and high-angle faults
3) Describe and measure map-scale and outcrop-scale folds
4) Construct a grid of cross-sections over the map area
5) Create an updated sequence of events for the area that can be correlated to regional sequences
6) Correlate pre-LFTB metamorphism in the Northern Sand Springs Range and Northern Wassuk Range

Methods:

1) Mapped in the field for a two week period using a topography map, GPS, Brunton compass, and aerial photos
2) Made interpretations of geology using satellite imagery
3) Studied typical units in thin section with a petrographic microscope
4) Used data gathered in the field to create a tied grid of cross sections to project the three dimensional subsurface into two dimensions
5) Plotted data onto stereonets to better interpret fold orientations

Image showing the foliation within the foliated marble. Foliation defined by white and grey bands.

Image showing the foliation within the andalusite schist. Foliation is defined by the parting between foliation planes.

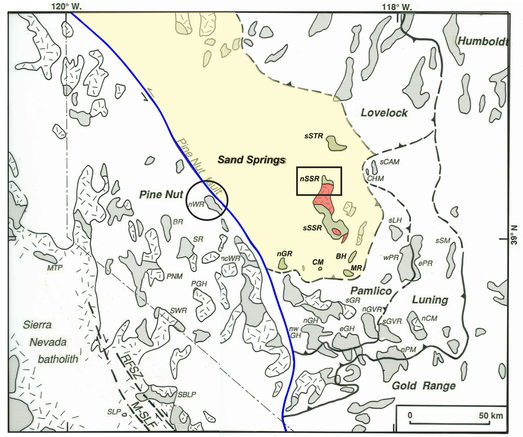
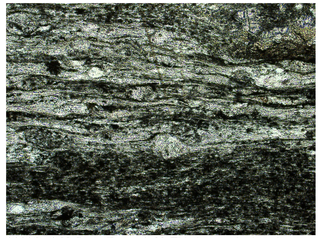


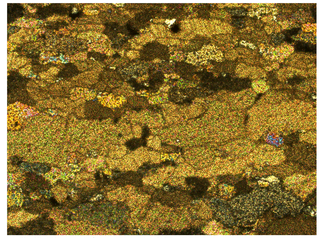
Image shows the regional location of the Sand Springs assemblage within the Luning-Fencemaker Fold and Thrust Belt (LFTB).

- The rectangle highlights the location of the Northern Sand Springs Range (nSSR) within the Sand Springs Assemblage.
- The circle highlights the location of the Northern Wassuk Range (nWR) within the Pine Nut Assemblage.
- The blue line highlights the Pine Nut Fault that generally acts as the boundary of Sierra Nevada related metamorphism.

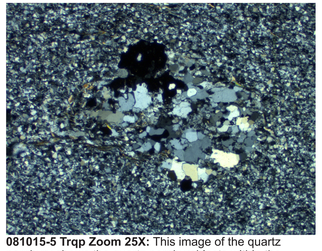
Thin Sections Showing Foliation Within the Metamorphic Units:



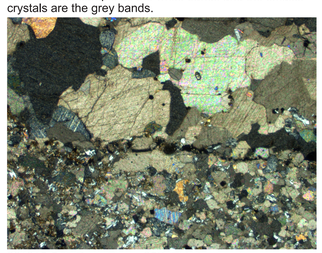
082015-2 MzPzas Zoom 25X: This image depicts the alignment of minerals that define the foliation within the Andalusite Schist.



081515-1 MzPzfm Zoom 25X: This image shows the variation in size of calcite crystals within the foliated marble that define the foliation. The larger crystals are seen in hand sample as the white bands and the smaller crystals are the grey bands.



081015-5 Trqp Zoom 25X: This image of the quartz porphyry shows the quartz porphyroblasts within the aphanitic matrix of quartz crystals.



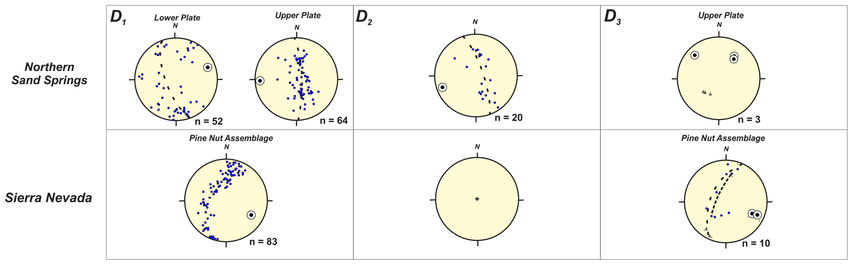
081915-5 MzPzqs Zoom 25X: This image shows a locally calcareous region of the quartz schist. The metamorphism in this unit is defined by the variation in crystal sizes.

Photo of Jacob Jarvis (foreground) and Sean Czarnecki (background) at the end of a long day taking measurements within the andalusite schist and along the thrust fault circling the middle klippe.

Conclusion:

- Three separate stages of deformation have been constrained within the Northern Sand Springs Range
- Timing constraints place deformation of the LFTB to be from mid-Jurassic to mid-Cretaceous
- D1 is a pre-LFTB syntectonic metamorphic event that is related to the NW trending D1 within the Sierra Nevada.
- D1 achieved amphibolite facies metamorphism that has not been previously documentated within the LFTB
- Typical metamorphism within the LFTB is subgreenschist or lower greenschist with NE trending S1 cleavage
- nSSR S1 foliation do not align perfectly with nWR S1 foliation due to overprinting of D2 in the nSSR and the absence of D2 in the nWR.

Stereonets Showing Deformation Phases and Related Folds and Foliations of The Northern Sand Springs Range and the Sierra Nevada



This figure shows three deformation events within the Luning-Fencemaker fold and thrust belt. S1 is a pre-LFTB Sierra Nevada related metamorphic foliation. As shown, D2 is not present within the Sierra Nevada and does not overprint S1. In the Sand Springs assemblage S1 is overprinted by D2 and D3 sequences. This accounts for the scatter in S1 measurements and the overall NE trending axial planes within S1. Since D2 is not present within the Sierra Nevada, axial planes within S1 follow the NW trend of D3.

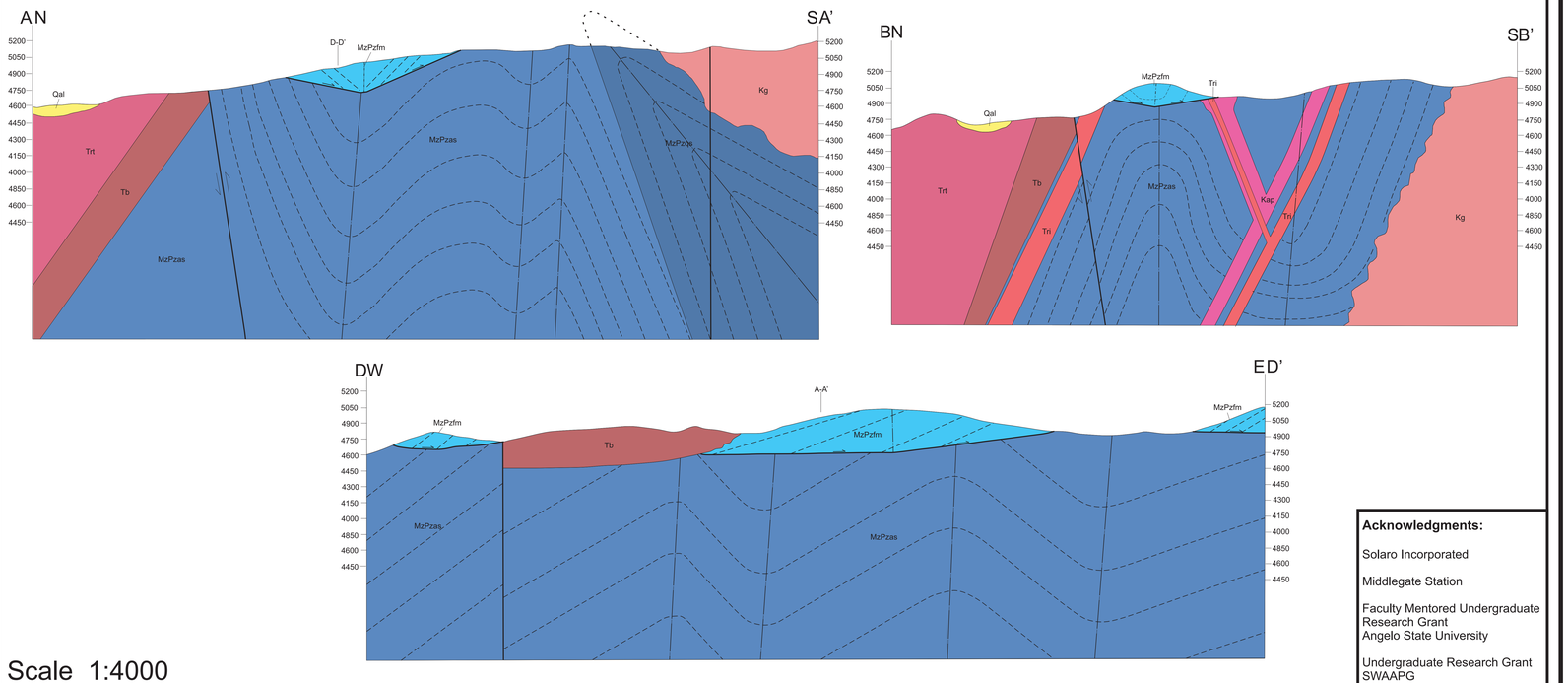
Field Pictures Representing D1-D3:

D1: This image shows outcrop scale D1 folds within S1 in the andalusite schist. D1 axial planes have an overall NW strike but have been highly altered by the following two LFTB deformation phases.

D2: This image shows the thrust fault of the eastern most klippe folded into a D2 map scale fold. D2 axial planes have an overall NE strike and plunge to the S-SW. This image was taken looking to the east from the middle klippe.

D3: This image shows the thrust fault of the western most klippe folded into a broad map scale D3 fold. D3 axial planes trend overall NW. This image was taken looking north from the south of the western most klippe.

Cross Sections:



Scale 1:4000

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